15129/US Hz/hr

CLAIMS (as originally filed and published)

1. Process for obtaining an object image of at least one object (40), wherein at least two partial images of the object (40) are taken under differing object conditions which are formed on the object with spatial patterns, wherein a non-linear dependence of the light detectable from the object point on the object conditions obtaining at the object point exists and the partial images contain different contributions of various space frequency components of the object structure, and the desired object image is determined from the partial images by reconstruction of the space frequency components.

2. Process according to claim 1, wherein spatial patterns of at least one object condition are formed, for each of which the non-linear dependence of the detected light emitted from the object point exists.

3. Process according to claim 1, wherein spatial patterns are formed by at least two object conditions, for which a dependence of the detected light on a multiplicative linking of the object characteristics and a linear or a non-linear dependence of the detected light on each of the object conditions exists.

4. Process according to one of the preceding claims, wherein the spatial pattern is given by a pattern of an illumination intensity on the object (40) and the object (40) is illuminated with the pattern of the illumination intensity in such a way that a non-linear dependence of the light intensity, detected at a detector device (60), coming out from an object point to

the illumination intensity obtaining at this object point exists.

5. Process according to one of the preceding claims, wherein the non-linear dependence of the detected light is formed by a saturation of fluorescence light of fluorophors under intensive illumination, a saturation of the absorption of illumination light under intensive illumination, a dependence of the phase of the emitted or scattered light on the illumination intensity present in the object, SHG or THG processes, a dependence of the light characteristics of the Raman scattering on the value of one or more object characteristics, temporally coherent effects on atoms or molecules in the object (40), multiphoton absorption, CARS processes, stimulated emission, population of longer-lived states or chemically altered states, radiative or radiation-free energy transfer processes of fluorophors to neighboring fluorophors, nonhomogeneous electric or magnetic fields obtaining at the object point, pressures, shear forces, or mechanical tension relationships obtaining at the object point, temperatures obtaining at the object point, chemical relationships obtaining at the object point, and/or additional object irradiations with electromagnetic rays or sound waves.

6. Process according to one of the preceding claims, wherein the spatial pattern of an object condition in reciprocal space can be described or approximately described by a number of points which are distributed in one, two, or three dimensions, or is formed spatially periodically or approximately periodically in one or more dimensions in the location space.

7. Process according to one of the preceding claims, wherein the object and the spatial pattern are dis-

placed in one or more directions relative to one another to achieve various object conditions.

8. Process according to claim 7, wherein the pattern is generated by a mask or by interference and a displacement of the mask is achieved by displacement of the phase of various diffraction maxima.

9. Process according to one of the preceding claims, wherein the object conditions are changed according to a predetermined temporal structure and the partial images are taken at various times.

10. Process according to claim 9, wherein the illumination intensity is varied to generate different object conditions.

11. Process according to one of the preceding claims, wherein the reconstruction of the object image from the partial images is performed by solving an equation system, taking into account the non-linear dependencies, or by an iterative procedure.

12. Process according to one of the preceding claims, wherein the position of the object or one or more partial objects of the object (40) is established.

13. Process according to one of the preceding claims, wherein the reconstruction of the object image is performed taking into consideration a previously known structure of the object (40) or of parts of the object (40).

14. Optical imaging system (100) having an illumination device (10) and a detector device (60), which are set up for illuminating an object (40) and recording an image of the object (40) or of parts of the object

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(40), characterized by at least one pattern generator (20, 20', 20") for generating at least one changeable spatial pattern of object conditions on the object (40), with the illumination device (10) and/or the pattern generator (20, 20', 20") being set up for generating object conditions on which the light detectable by the detector device (60) is nonlinearly dependent, and an image generator (70) for reconstruction of an object image from partial images which were recorded with the detector device (60).

15. Optical system according to claim 14, wherein the pattern generator (20, 20', 20") comprises a mask with which a spatial pattern of an illumination intensity can be formed on the object (40).

16. Optical system according to claim 15, wherein the mask comprises a multidimensional diffraction grating (22), a phase grating, a DMD device, or an LCD matrix.

17. Device according to claim 15 or 16, wherein the mask and the sample (40) are positioned so they are movable and/or rotatable relative to one another.

18. Optical system according to claim 14, wherein the pattern generator (20, 20', 20") comprises a mirror assembly (23-27) which is set up for generating of an interference pattern on the object (40).

19. Optical system according to claim 14, wherein the pattern generator (20, 20', 20") comprises a device for achieving predetermined physical or chemical conditions on the object (40) corresponding to the spatial pattern.

20. Optical system according to claim 14, wherein an adjustment device for displacement of the object (40) in

the spatial pattern of the object conditions is provided.

21. Optical system according to one of the claims 14 to 20, wherein the illumination device (10) comprises a flash lamp, a laser, or a high-pressure lamp.

22. Optical system according to one of the claims 14 to 21, wherein an illumination optic (30) and/or an imaging optic (50) are provided.

23. Usage of a process or an optical system according to one of the preceding claims in combination with typical optical microscopy processes, particularly in combination with standard far field microscopy, epifluorescence microscopy, confocal microscopy, 4Pi microscopy, theta microscopy, near field microscopy, microscopic I^2M, I^3M, and I^5M processes, STED processes, multiphoton microscopy, CARS processes, and SHG or THG microscopy.